Impacts de la variabilité hydro-climatique sur la dynamique des remontées salines dans l'estuaire du fleuve Casamance (Sénégal) (Oral)

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ABSTRACT

Rainfall provides about 58% of the freshwater input to the Casamance River, making this estuary highly sensitive to hydroclimatic variability, especially in its downstream part. This sensitivity has been clearly illustrated during past climatic extremes. The long Sahelian drought (1968–1995) led to a strong decrease in rainfall and river discharge, causing exceptional hypersalinization of the estuary. Salinity values reached up to 170 PSU more than 150 km upstream from the mouth, and the salt front extended beyond Sobali, over 220 km inland. Since the early 2000s, the partial recovery of rainfall has reduced these extreme conditions. However, high salinity levels still persist, reaching about 50 PSU in the main channel and up to 100 PSU in some tributaries. The estuary shows a strong seasonal hydrodynamic behavior. During the rainy season, it functions as a "normal" estuary due to significant freshwater inflow. In contrast, during the dry season, it behaves as an "inverse" estuary because of very low river discharge and high evaporation. During this period, tidal marine intrusions can reach Diana Malari, about 217 km upstream, leading to strong hypersalinization, especially in areas with low water renewal. This situation represents a major threat to the socio-ecosystem, particularly mangroves and rice farming, which are essential in the region. The aim of this study is to analyze the interactions between hydroclimatic variability and salinity dynamics in the Casamance estuary. The methodology is based on (i) rainfall variability analysis using data from eight stations, (ii) reconstruction of daily river discharge using the GR4J hydrological model, and (iii) analysis of salinity dynamics using historical data (1966–2016), complemented by four seasonal field campaigns conducted between 2024 and 2025. The results show a strong relationship between rainfall variability, river discharge, and saline intrusion intensity. A decrease in rainfall leads to lower river discharge, which allows the salt front to move further upstream. Conversely, periods of high rainfall reduce salinity levels and push the salt front downstream. Recent observations confirm the dominant role of climatic forcing in controlling salinity dynamics, while also highlighting the persistence of hypersaline conditions inherited from past drought periods. These findings improve the understanding of inverse estuary functioning in Sahelian environments and provide useful insights for sustainable water resource management under increasing climate variability.

Keywords: Hydroclimatic variability, Saline intrusion dynamics, Casamance estuary.